



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|------------------------|---------------------|------------------|
| 10/558,383 | 11/07/2006 | Masato Yamazaki | Q90710 | 4172 |
| 23373 7590 11/07/2008 SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037 | | | | |
| EXAMINER ROSENAT, DEREK JOHN | | | | |
| ART UNIT 2834 | | PAPER NUMBER | | |
| MAIL DATE 11/07/2008 | | DELIVERY MODE PAPER | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/558,383

Applicant(s)

YAMAZAKI ET AL.

Examiner

Derek J. Rosenau

Art Unit

2834

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 August 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)
Paper No(s)/Mail Date _____

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4, 6-10, and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (US 6093339) in view of Kennedy et al. (US 2003/0199228).
3. With respect to claim 1, Kimura et al. discloses a piezoelectric ceramic composition characterized by containing: metallic element K; metallic element Na; metallic element Nb (column 2, line 60 through column 3, line 6); M1, which represents a divalent metallic element, or a metallic element combination formally equivalent to a divalent metallic equivalent (column 2, line 60 through column 3, line 6); M2, which represents a tetravalent metallic element, or a metallic element combination formally equivalent to a tetravalent metallic element (column 2, line 60 through column 3, line 6); non-metallic element O, wherein K, Na, Nb, M1, and M2 constitute the formula $[(1/2)aK_2O - (1/2)bNa_2O - cM1O - (1/2)dNb_2O_5 - eM2O_2]$, a, b, c, d, and e in the formula satisfy the following relations: $0.2 < a < 0.5$, $0 < b \leq 0.25$, $0 < c < 0.11$, $0.4 < d < 0.56$, $0 < e < 0.12$, $0.4 < a + b + c \leq 0.5$, and $a + b + c + d + e = 1$ (column 2, line 60 through column 3, line 6). The relationships between x, y, z, m, and n of Kimura et al. and a, b, c, d, and e, of the claims is as follows: $a = (1/2)(1-n)(m)(1-(x+y))$, $b = (1/2)(1-n)(m)(x)$, c

$= (1/2)(n)$, $d = (1/2)(1-n)(1-z)$, and $e = (1/2)(n)$. Given these formulas, and the limits provided for x , y , z , m , and n , the ranges for a , b , c , d , and e for Kimura et al. would be as follows: $0.11025 < a < 0.45$, $0.0441 < b < 0.375$, $0 < c < 0.05$, $0.315 < d < 0.5$, and $0 < e < 0.05$.

Kimura et al. does not disclose expressly that the ceramic composition contains M3, which represents a metallic element of a sintering aid component and which is at least one of Fe, Co, Ni, Mg, Zn, and Cu, or that when the total amount of K, Na, Nb, M1, and M2 as reduced to corresponding oxides is 100 parts by mass, the amount of M3 as reduced to M3 oxide is 5 parts by mass or less.

Kennedy et al. teaches a piezoelectric ceramic composition that includes M3, which represents a metallic element of a sintering aid component and which is at least one of Fe, Co, Ni, Mg, Zn, and Cu, or that when the total amount of K, Na, Nb, M1, and M2 as reduced to corresponding oxides is 100 parts by mass, the amount of M3 as reduced to M3 oxide is 5 parts by mass or less (Paragraph 55).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the sintering aid, M3, of Kennedy et al. with the ceramic composition of Kimura et al. for the benefit of creating a ceramic composition that can be sintered more easily (Paragraph 55 of Kennedy et al.).

4. With respect to claim 2, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kennedy et al. discloses that when the total amount of K, Na, Nb, M1, and M2 as reduced to corresponding oxides is 100 parts by mass, the amount of M3 as reduced to M3 oxide is 0.1 parts by mass or less (Paragraph 55).

5. With respect to claim 3, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that M1 is at least one of Ca, Sr, Ba, $(\text{Bi}_{0.5}\text{Na}_{0.5})$, and $(\text{Bi}_{0.5}\text{K}_{0.5})$ (column 2, line 60 through column 3, line 6).
6. With respect to claim 4, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that M2 is at least one of Ti, Zr, and Sn (column 2, line 60 through column 3, line 6).
7. With respect to claim 6, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kennedy et al. discloses that M3 is a combination of Cu and at least one of Fe, Co, Ni, Mg, and Zn (Paragraph 55).
8. With respect to claim 7, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that a, b, and d in the formula satisfy the following relation $(a + b)/d \leq 1.00$ (column 2, line 60 through column 3, line 6). Given the equations provided above, and the ranges for x, y, x, n, and m, the range of possible values for $(a+b)/d$ would be as follows: $.2205 < (a+b)/d < 2.38$.
9. With respect to claim 8, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that a, b, and c in the formula satisfy the following relation: $0 < c/(a + b + c) \leq 0.20$ (column 2, line 60 through column 3, line 6). Given the equations provided above,

and the ranges for x, y, x, n, and m, the range of possible values for $c/(a+b+c)$ would be as follows: $0 < c/(a+b+c) < .0625$.

10. With respect to claim 9, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that in addition to K, Na, Nb, M1, M2, and M3, metallic element Li, wherein at least one of K and Na in the formula is partially substituted by Li (column 2, line 60 through column 3, line 6).

11. With respect to claim 10, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that in addition to K, Na, Nb, M1, M2, and M3, metallic element Ta, wherein Nb in the formula is partially substituted by Ta (column 2, line 60 through column 3, line 6).

12. With respect to claim 12, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses that the piezoelectric composition has a perovskite crystal structure. While Kimura et al. does not explicitly state that the composition has a perovskite structure, this is merely an inherent property of the material. As Kimura et al. discloses the claimed composition, that composition would have the same material properties as the claimed composition.

13. With respect to claim 13, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 12. Kimura et al. discloses that the perovskite crystals belong to an orthorhombic system. While Kimura

et al. does not state explicitly that the crystals of the composition belong to an orthorhombic system, this is merely an inherent property of the material. While there may be examples of perovskite materials that are not orthorhombic, the crystal structure remains an inherent material property. As Kimura et al. discloses the claimed composition, that composition would have the same material properties as the claimed composition.

14. With respect to claim 14, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1. Kimura et al. discloses at least a pair of electrodes which are in contact with the piezoelectric member (column 4, lines 57-59).

15. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. in view of Kennedy et al. and Nishida et al. (US 2002/0066882).

16. With respect to claim 11, the combination of Kimura et al. and Kennedy et al. discloses a piezoelectric ceramic composition as described in claim 1.

Neither Kimura et al. nor Kennedy et al. discloses expressly that the composition contains, in addition to K, Na, Nb, M1, M2, and M3, metallic element Sb, wherein Nb in the formula is partially substituted by Bb.

Nishida et al. teaches a piezoelectric ceramic composition in which metallic element Sb partially substitutes for Nb (Paragraphs 7 and 8).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the Sb of Nishida et al. with the piezoelectric ceramic composition

of Kimura et al. as modified by Kennedy et al. as Sb is a well-known functional alternative to Nb, and Ta (Paragraph 8 of Nishida et al.).

Response to Arguments

17. Applicant's arguments filed 6 August 2008 have been fully considered but they are not persuasive.

18. Applicant argues that Kimura et al. does not disclose all of the claimed composition ranges for a, b, c, d, and e. Applicant argues that because $x+y \geq 0.75$, and because $0.02 < y \leq 0.3$, that x would then be greater than or equal to 0.45, which would put it outside of the claimed range of 0 to 0.25. However, in an alternative embodiment of Kimura et al. $x+y < 0.75$. In this embodiment, the corresponding ranges for a, b, c, d, and e would be as follows: $0.11025 < a < 0.45$, $0.0441 < b < 0.375$, $0 < c < 0.05$, $0.315 < d < 0.5$, and $0 < e < 0.05$. Therefore, the compositional ranges for a, b, c, d, and e are all, at least partially, within the claimed ranges.

19. Applicant argues that the lower limit of the ratio a/b for the claimed invention is 0.8, and that for the invention of Kimura et al., the maximum ratio for a/b is 0.56. First, there are no claim limitations directed to the ratio a/b. Second, this argument only pertains to embodiment of Kimura et al. in which $x+y \geq 0.75$.

20. Applicant argues that it would not be obvious to combine Kennedy et al. with Kimura et al. as Kennedy et al. is not directed to a piezoelectric composition, and because Kennedy is not intended to improve piezoelectric characteristics. However, Kennedy et al. is cited merely for its teaching of a known sintering aid for use when sintering ceramic materials. Therefore, as the material of Kimura is a ceramic material,

in which sintering is used its process of manufacturing, it would have been obvious to use the sintering aid taught by Kennedy et al. with the piezoelectric ceramic material of Kimura et al.

Conclusion

21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek J. Rosenau whose telephone number is (571) 272-8932. The examiner can normally be reached on Monday thru Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leung Quyen can be reached on (571) 272-8188. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Quyen P Leung/
Supervisory Patent Examiner, Art Unit 2834

Derek J Rosenau
Examiner
Art Unit 2834

/D. J. R./
Examiner, Art Unit 2834